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AFFINITIES OF THE FLORA OF THE ILLINOIAN TILL PLAIN OF SOUTHWESTERN OHIO[1]

E. Lucy Braun

The Illinoian till plain of southwestern Ohio[2] is a more or less delimited floristic district distinguished from adjacent areas by the presence of a group of characteristic species, by the occurrence of a number of species not in adjacent areas, by the greater abundance or even dominance of certain species rare or absent in either of the adjacent areas, and by the pronounced northern affinity of its flora. It is further marked by the paucity of its flora and by the absence of most of the showy spring flowers abundant in hillier sections of southern and southwestern Ohio, as *Erythronium, Trillium, Camassia, Anemonella, Isopyrum, Hepatica, Delphinium, Aquilegia, Jeffersonia, Sanguinaria, Stylophorum, Dicentra, Erigenia, Hydrophyllum, Mertensia, Senecio* and others.

Eastward, the till plain is separated by but a short distance from the eastern margin of the Interior Low Plateau with its prairie relic communities with rich mid-western flora, and from the Allegheny Plateau with its distinctly Alleghenian flora. (Braun, 1928a.) Westward, it overlaps the Cincinnati region, a dissected limestone and

[1] The reproduction of the maps in this paper is made possible through aid to Rhodora from the National Academy of Sciences.

[2] This area covers approximately 1500 square miles to the east of the Little Miami River (Figs. 4 and 5). Topographically, it is a flat or nearly flat upland, in places as yet little dissected by stream valleys, and covered by a mantle of glacial drift of Illinoian age. Due to the youthful topography of parts of the area, certain habitats have remained relatively unchanged since the Pleistocene. Acid soils prevail in the area; the Clermont silt loam or "white clay" is the most characteristic, and has developed on all the flattest portions of the area. Because of poor drainage, hydromesophytes find favorable habitats. The plant ecology of this region is treated in "Forests of the Illinoian till plain of Southwestern Ohio," Ecological Monographs, in press.

drift area (Braun, 1916). Northward, it is bounded by the rolling Wisconsin glacial plains which comprise a large section of western Ohio. In number of species it is much poorer than the regions to east or west, though it contains some found neither to east or west.

Plants of Illinoian Till Plain not found in adjacent areas, or abundant or characteristic in the till plain and rare or absent in either of the adjacent areas. Presence percentage indicated by the 1 to 5 scale; absence by X.

	Cincinnati Region	Illinoian Till Plain	Mineral Springs Reg.		Cincinnati Region	Illinoian Till Plain	Mineral Springs Reg.
Aspidium noveboracense	*	2	3	Viola lanceolata	X	1	X
Lophotocarpus calycinus	X	1–	X	Viola pallens	X	1–	X
Juncus bufonius	X	1	1	Viola sagittata	X	1	3
Luzula campestris var. bulbosa	X	1	X	Rhexia virginica	X	1	1–
Uvularia perfoliata	X	1	2	Cornus racemosa	X	3	X
Smilax Bona-nox	X	2	4	Chimaphila maculata	†	2	1
Habenaria peramoena	1–	3	X	Vaccinium stamineum	X	1	4
Tipularia discolor	X	1–	1	Vaccinium vacillans	X	1	4
Salix discolor	1–	3	X	Gentiana Saponaria	X	1–2	X
Polygonum arifolium	1–	2	X	Phlox maculata var. odorata	X	2–3	X
Polygonum sagittatum	1	3	1	Myosotis virginica var. macrosperma	X	1	X
Stellaria longifolia	*	2	X	Verbena hastata	1	1	X
Ranunculus laxicaulis	X	1	X	Trichostema dichotomum	*	1	X
Ranunculus pusillus	X	1–	X	Pentstemon calycosus	1	1	X
Ranunculus hispidus var. falsus	X	4	X	Pentstemon digitalis	1	1	X
Anemone quinquefolia	X	1	1	Gerardia flava (Aureolaria flava)	X	1	1
Cardamine bulbosa	1	3	X	Galium tinctorium	*	2	X
Spiraea tomentosa	X	3+	X	Mitchella repens	1–	4–	2
Spiraea alba	X	1–2	X	Viburnum pubescens var. indianense	X	4+	X
Spiraea latifolia	X	1–	X	Viburnum Lentago	X	1–	X
Pyrus melanocarpa	X	2–3	X	Lobelia puberula	X	1	1
Rubus hispidus	X	1	X	Lobelia cardinalis	*	3	1
Rosa carolina (Rosa palustris)	1	4	X	Vernonia noveboracensis	X	1–	X
Baptisia leucantha	‡	1–	X	Solidago rugosa	X	3+	X
Linum striatum	1	1	X	Aster umbellatus	X	3	X
Callitriche heterophylla	X	1	1	Solidago serotina	1	1	X
Ilex verticillata	*	4+	X	Pluchea petiolata	X	1–	X
Vitis labrusca	*	4	X	Hieracium marianum	X	1	X
Viola cucullata	*	3	1				

* Only in flat upland areas of the Cincinnati region, and hence in habitats which are western outliers of the till plain.

† Present in one station only.

‡ Reported nearly 100 years ago from one station which was ecologically similar to the till plain; now extinct (Braun, 1934).

Of approximately 200 species (exclusive of trees, grasses and sedges) of the till plain communities, 35 do not occur in the dissected Cincinnati region or even in dissected areas in the counties in which the till plain is most extensive and 39 do not occur in the Mineral Springs region of Adams County which is but a short distance to the east. Of these, 23 occur in neither region. The occurrence of 51 species absent in adjacent regions to east or west or both, emphasizes the floristic distinctness of the till plain. These species and six additional which are very rare to east or west are listed in the accompanying table, together with presence percentage (Pr %) of each.[1] Grasses and sedges are not included because of incomplete records.

The geographical distribution of the eight species of trees of highest percentage occurrence (Pr %) in the till plain is shown in the map, Fig. 1. Of these trees, only *Liquidambar styraciflua*[2] is floristically distinctive; the rest are general in Ohio. It is not found west of the till plain in southwestern Ohio, though it is abundant in the "Flats" of southeastern Indiana. Eastward, in the Allegheny region, it is a tree of alluvial flats. In the till plain, it is general only in the southern half (Fig. 2A) and scattered in the northern part. North of the till plain it is known in only a few stations. Similarly in Indiana, *Liquidambar* extends just north of the Illinoian drift area (Lindsey, 1932). Its known distribution in Ohio, Indiana and Kentucky is such as to suggest a relation to preglacial drainage patterns (Fig. 2B); due to post-glacial migration it has extended its range slightly into adjacent favorable territory. *Fraxinus profunda,* a distinctly southern species of the Mississippi embayment, is present in two stations in the till plain and not elsewhere in Ohio. Cow oak (*Q. Michauxii* Nutt. or *Q. Prinus* L), one of the characteristic trees of the Indiana "Flats" (Lindsey, 1932) does not enter our area.

Certain of the shrubs are very characteristic of this area. A larger number of shrubs is present than in the adjacent dissected areas. All except those of late successional stages are species requiring abundant soil moisture or acid soil or both. The widespread species are best represented by *Cephalanthus occidentalis,* which is transcontinental in range and reaches from the Gulf of Mexico to Canada. This species

[1] "By presence is meant the more or less persistent occurrence of a species in all the stands of a certain community." (Braun-Blanquet, 1932). As defined by Cain (1932). "Presence concerns the degree of regularity with which species reoccur in different examples of an association." This may be expressed in percentage, or less exactly, in the 1 to 5 scale suggested by both Braun-Blanquet and Cain.

[2] Nomenclature according to Gray's New Manual of Botany, 7th edit., 1908, except as noted.

is generally distributed in the wettest places in the till plain. Alleghenian species of acid soils are represented by *Vaccinium stamineum* (Fig. 4A) and *V. vacillans*, both of which are rare and local in the till plain. *Smilax glauca* (Fig. 4B), of southern range, is common, though

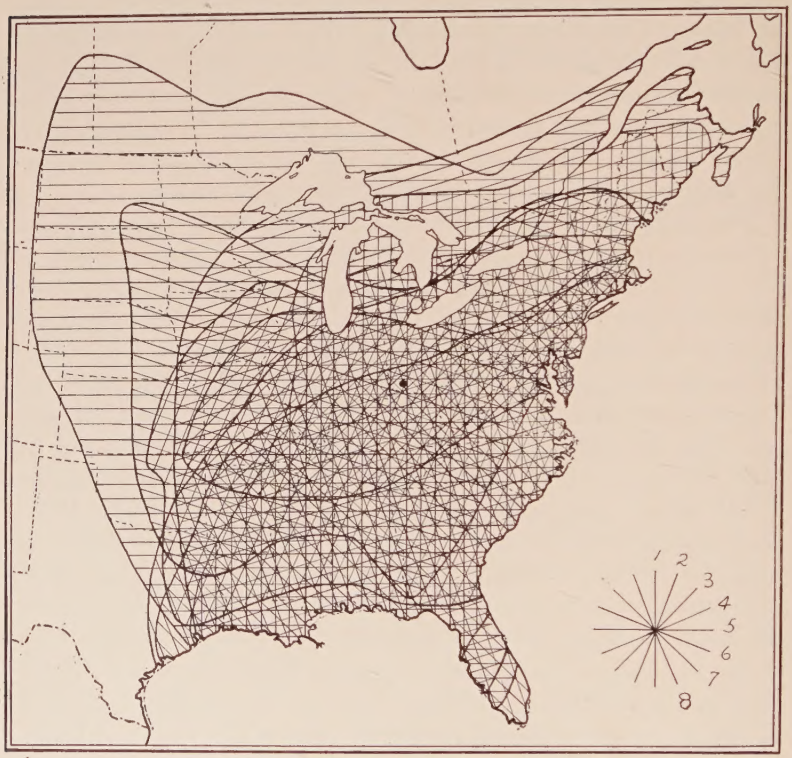

Fig. 1. Geographic distribution of eight trees of highest percentage occurrence in the till plain. Spokes of wheel in lower right-hand corner give direction of lines used for species indicated by numbers at ends of spokes:

1. Fagus grandifolia
2. Quercus alba
3. Quercus palustris
4. Acer rubrum
5. Ulmus americana
6. Carya ovata
7. Liquidambar styraciflua
8. Nyssa sylvatica

southern species are on the whole few and unimportant in the area. Northern and northeastern species, as *Vitis labrusca, Spiraea tomentosa* (Fig. 4C), *Spiraea alba, Ilex verticillata, Pyrus melanocarpa, Rubus hispidus, Salix discolor* and *Viburnum Lentago*, prevail. The map, Fig. 3, of the superimposed ranges of these eight species emphasizes

the general northeasterly range of the shrub flora of initial and intermediate successional stages. *Viburnum pubescens* var. *indianense* Rehder, is an endemic of the Illinoian till plain of Indiana and Ohio;

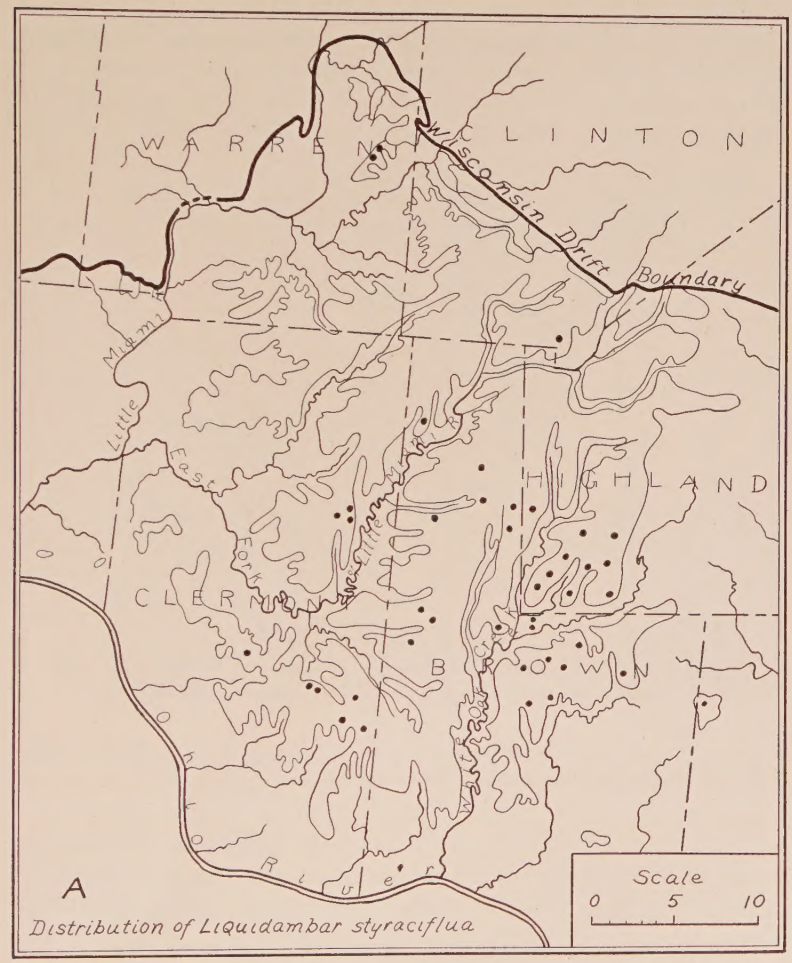

FIG. 2A. Distribution of LIQUIDAMBAR STYRACIFLUA in the Illinoian till plain (See FIG. 5).

the species from which it is isolated is of northern distribution. This is in contrast to that of the trees, which is to be expected, as the trees entered later with the advance of forest after Illinoian glaciation. *Rosa setigera* and *Hypericum prolificum* are more central in range.

As the later successional stages are reached and the vegetation approaches the climatic climax, shrubs of more southerly or wider range enter, as *Benzoin aestivale*, *Asimina triloba* and *Sambucus canadensis*.

Among the herbaceous plants, great variety is exhibited in types of geographic ranges. Species whose general range is comparable to that of deciduous forest prevail; this distribution is illustrated by *Medeola virginica*, *Polygonum sagittatum*, *Chelone glabra*, *Lobelia*

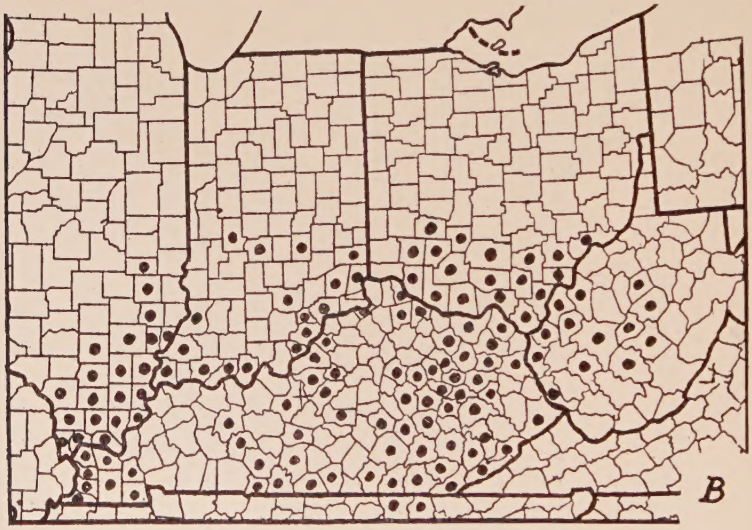

Fig. 2B. Distribution of Liquidambar styraciflua in the Ohio Valley region (Data by courtesy of E. N. Transeau).

cardinalis and *Solidago rugosa* of pin oak openings and secondary meadows and by *Pedicularis canadensis* and *Mitchella repens* of initial and intermediate forest stages of succession. All of these occur on the Illinoian till plain of Ohio and Indiana and are more or less generally distributed in these states.

Certain species, as *Aspidium noveboracense*, *Polygonum arifolium*, and *Chimaphila maculata* (Fig. 4D) are somewhat more eastern in range. Such species are general in eastern (Alleghenian) Ohio and more local westward in Ohio and Indiana.

Hierochloë odorata (Fig. 4E), *Anemone quinquefolia*, *Viola cucullata*, *Viola lanceolata* and *Viola pallens* are the most northern in range of

the plants of the till plain. The distribution displayed by these species in Ohio and Indiana is of particular interest. All occur in the northern, particularly lake counties, of these states, and in certain southern counties, particularly those affected by Illinoian glaciation. *Hiero-*

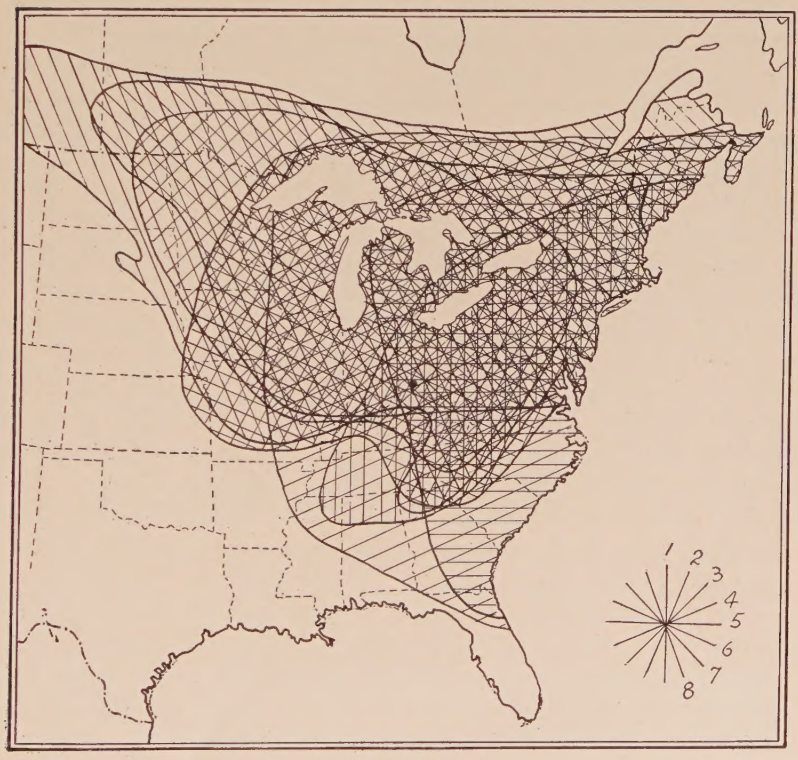

Fig. 3. Geographic distribution of eight characteristic shrubs of the till plain; pronounced northerly range evident:

1. Vitis labrusca
2. Spiraea tomentosa
3. Spiraea alba
4. Ilex verticillata
5. Pyrus melanocarpa
6. Rubus hispidus.
7. Salix discolor
8. Viburnum Lentago

chloë in Indiana is confined to the north. The gap between northern and southern stations is pronounced in all except *Anemone quinquefolia,* a more mesophytic species than the others. This distribution appears to be related to glacial and post-glacial migrations; in the southern stations the species are relics (Braun, 1928b). Their absence from intermediate stations may be due to the Wisconsin xerothermic period.

Lilium canadense, *Houstonia caerulea* and *Aster umbellatus* are intermediate in range between the northern species and species of deciduous forest range. They display more general distribution in Ohio and Indiana than the more northern species. However, in Indiana there is some evidence of disruption in range between the "Flats" and other more northern stations for these species. This is to be expected if the peculiarity of ranges of these and the group of more northern species is a result of glacial migrations and climatic restrictions. *Phlox maculata* var. *odorata* (Sweet) Wherry and *Ranunculus hispidus* var. *falsus* Fernald are northern varieties of more widely distributed species. Both are common on the till plain. The distribution of the former is mapped by Wherry (1932).

Only one herbaceous plant of the till plain (an amphibious plant) is extremely southern in distribution, namely *Ranunculus pusillus*, a plant of the Atlantic and Gulf Coastal Plain and Mississippi embayment. It is known from only one county in Ohio and one county in Indiana, both stations in the Illinoian till plain. *Lobelia puberula*, *Rhexia virginica* (Fig. 4G), *Tipularia discolor* (Fig. 4H), *Pluchea petiolata* and *Lophotocarpus calycinus* (Fig. 4I) are southern plants, all more or less rare and local on the Illinoian till plain of Ohio. *Lobelia* is somewhat scattered in both Ohio and Indiana; *Rhexia* and *Tipularia* occur in the south and in the Lake counties in Ohio, *Tipularia* only in the south in Indiana. *Rhexia* displays a type of distribution common to many migrating southern plants—stations in unglaciated and adjacent glaciated territory, and along the Great Lakes whither they may have entered by Mississippi valley routes or eastern routes during or following the last or marine substage of the Pleistocene. These southern plants are, in contrast to the northern ones, regarded as relatively recent entrants in the till plain. *Lophotocarpus* is an example of a southern plant which is much more general in southern Indiana than in Ohio.

Habenaria peramoena (Fig. 4J), *Coreopsis tripteris* and *Baptisia leucantha* (Fig. 4K) are central in range, the first with most restricted range but very general in the till plain, the last more western in range and very local in the till plain. The distribution of *Baptisia* in Ohio (the western half of the state) and its distribution in Indiana (represented in all quarters) is in keeping with its usual community affiliations (prairie) and post-Wisconsin eastward migration. *Habenaria*, south-central in range, is in both states confined to southern stations, unglaciated and glaciated.

Wides, as is to be expected, are best represented among the aquatic and amphibous species, though the most widespread and cosmopolitan of such species as *Typha latifolia, Spirodela polyrhiza, Lemna minor, Ceratophyllum demersum*, etc., are absent or rare in the till plain.

Representative examples of the distribution displayed in Ohio and Indiana[1] by plants of the several distribution types are shown in Fig. 4, A to K. To show relation of ranges to age areas of the states, a glacial map, Fig. 4L, is included.

To summarize, the flora of the Illinoian till plain, though composed largely of intraneous species, nevertheless contains a considerable percentage of forms which, if not actually extraneous, have somewhat discontinuous ranges as demonstrated by their absence from adjacent areas. Its species are derived from different floristic regions: species of the deciduous forest region prevail; western species are poorly represented; a few Alleghenian species from the nearby Allegheny Plateau are present; the southern element is represented by tree, shrub and herb species; the strong northern affinity of the flora is demonstrated by a considerable group of species of north-northeastern range. This northern affinity is also indicated by the "life form spectrum" of the younger successional communities (Withrow, 1932).

The explanation of the ranges of species which occur on the till plain is to be found in post-Illinoian and recent migrations; post-Wisconsin movements seem inadequate to explain the distribution of the group of northern species. The absence of western species, other than the mid-western *Baptisia leucantha* (Fig. 4K), is in contrast to areas to east and west where relic prairie species do occur. The prairie relics to the west in the Cincinnati region are certainly of Wisconsin age; those to the east in Adams County have been interpreted in a previous paper (Braun, 1928b) as of pre-Illinoian age. The absence of true loess in the region to the east of the Little Miami River—in the area of the Illinoian till plain—is evidence that the Wisconsin xerothermic period was not extreme in this area and hence that occupying vegetation was not displaced by more xeric types. The lack of disturbance to vegetation in southern Ohio by the Wis-

[1] Ohio distributions are taken from Schaffner, Revised Catalog of Ohio Vascular Plants, 1932; and from Transeau and Williams, 1929. The distribution of Indiana shrubs from Deam, 1932; of grasses, Deam, 1929. For other distributions, the writer is indebted to Miss Dorothy Parker who has secured the data from distribution records filed at Butler University.

consin xerothermic period is further attested by the boreal relics along the nearby glacial border to the east, and by the many Tertiary relics, as *Styrax*, *Calycanthus*, *Halesia*, in unglaciated territory not far from the glacial boundary, and by the marked contrast between the vege-

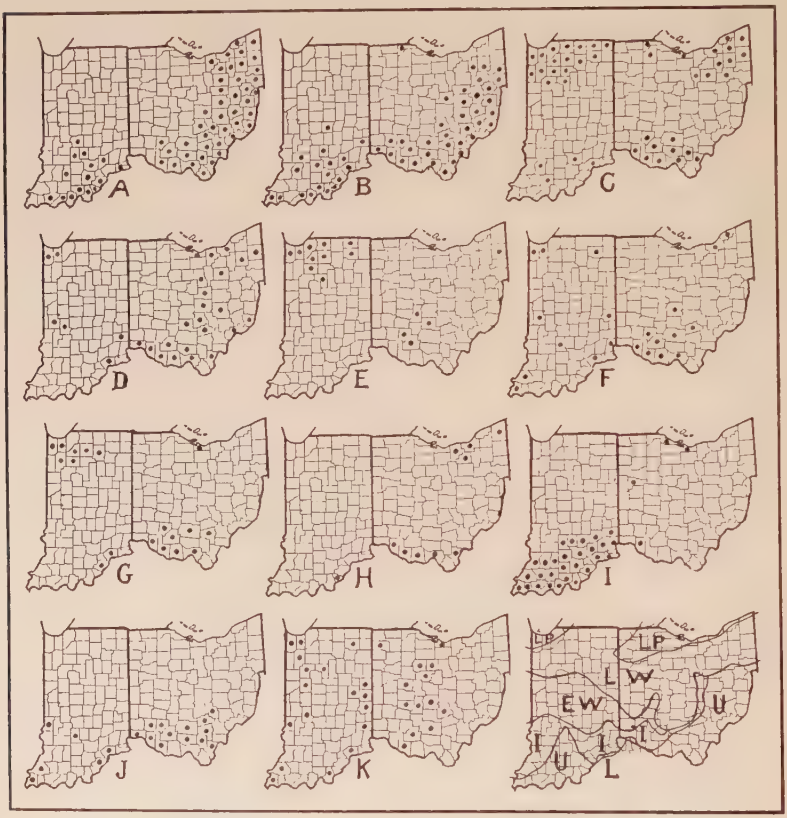

Fig. 4. Examples of types of distribution in Ohio and Indiana displayed by plants of the Illinoian till plain:

A. Vaccinium stamineum
B. Smilax glauca
C. Spiraea tomentosa
D. Chimaphila maculata
E. Hierochloë odorata
F. Viola cucullata
G. Rhexia virginica
H. Tipularia discolor
I. Lophotocarpus calycinus
J. Habenaria peramoena
K. Baptisia leucantha

L. Glacial map of Ohio and Indiana (after Leverett):

U. Unglaciated area.
I. Illinoian drift.
EW. Early Wisconsin.
LW. Late Wisconsin.
LP. Lake plains of glacial Lakes Maumee and Chicago.

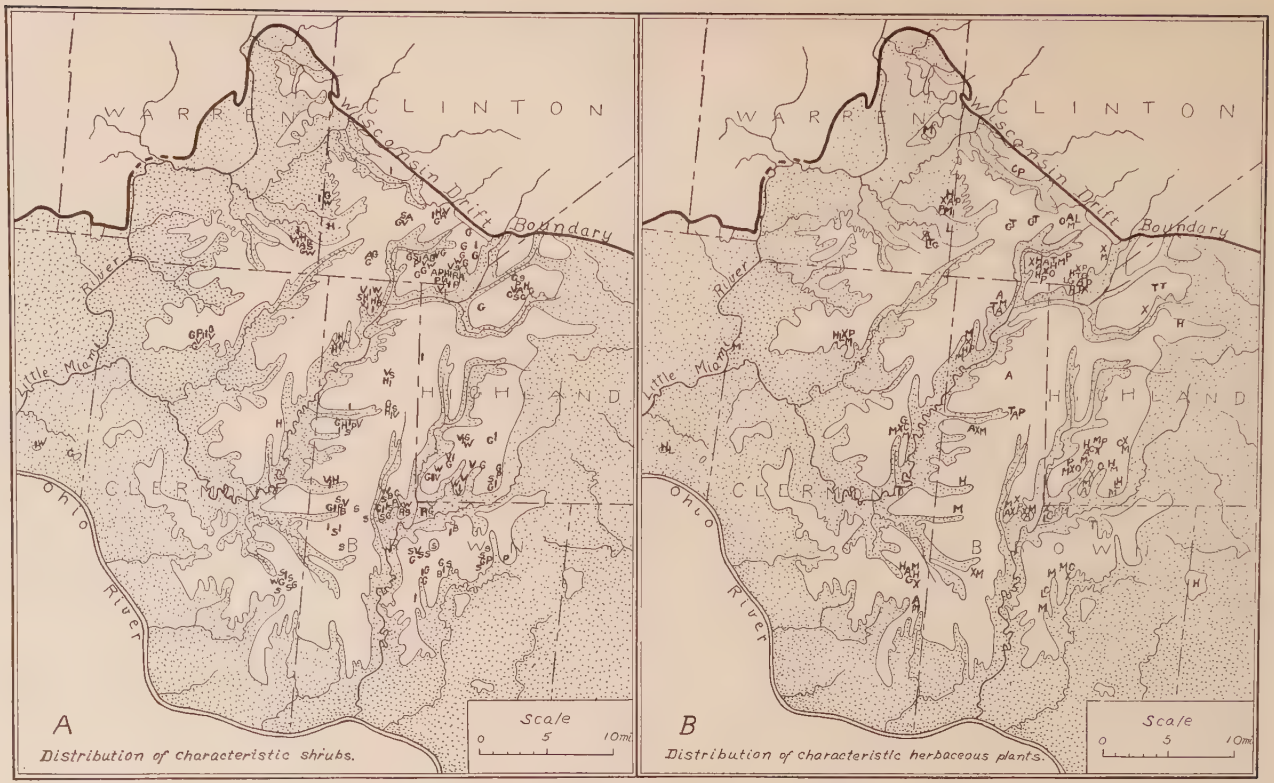

FIG. 5. Distribution on the till plain of characteristic shrub and herb species, showing mass occurrence in eastern and northeastern parts, greater rarity in western parts, and almost complete absence in northwestern part. White unshaded portions of map, south of Wisconsin drift boundary, are areas of Clermont silt loam—the flattest portions of the till plain.

tation, generally, of glaciated and unglaciated areas of Ohio. Boreal hydro-mesophytic species were able to persist on the Illinoian till plain throughout the period of Wisconsin glaciation and are represented today by the many plants of northern distribution. If they did later move across the Wisconsin drift area they were eliminated by the increasing aridity. Hence their ranges are remarkably disrupted. The occurrence of a young endemic of northern relationship—*Viburnum pubescens* var. *indianense*—is further evidence of the long isolation of the northern relics on the till plain. The same climatic condition which appears to be responsible for the disrupted ranges of the northern species made possible marked eastward movement of prairie. But, to the migrating prairie species the Illinoian till plain was unfavorable and few species were able to invade it. The long period of conifer dominance on the youngest glaciated land (the Wisconsin drift area) which is so amply demonstrated by pollen studies of Sears (1930, 1931) seems never to have affected this area, or any of the great southern lobe of the Illinoian glacier. That migratory movements of species are still in progress is indicated by the presence and behavior of southern species in the area (Fig. 2A). This element is relatively new. Though numerically few and for the most part found in but few stations, these species are important in pointing to the ultimate displacement of the northern relics.

The more general distribution and greater abundance of the characteristic species in the northeastern and eastern part of the till plain (Brown, Highland, Clinton counties), their greater rarity in the western part (Clermont County) and almost complete absence in the northwestern part (Warren County) raises some question as to the factors which may have affected the distribution of species within the area of the till plain (Fig. 5A, B). Certainly the effects of the Wisconsin xerothermic period would have been more pronounced in the western and northwestern parts of the area than elsewhere. Present unequal distribution of summer rainfall in the area, resulting in "dry islands," at least one of which is in an area of lesser abundance of characteristic species—the middle western part—coupled with the lowering of the water table by man's interference may have been detrimental to these species, all of which are hydro-mesophytes. The topography of the northwestern part of the area (Warren County) differs slightly from the rest of the plain; its ridges and depressions are longitudinal, lying in a northeast-southwest direction, instead of irregular, and the plain here tips southwestward. This part, too, is

partly surrounded by the Earlier Wisconsin drift. Position and topography suggest the possibility of some Wisconsin wash across this part of the plain. Thus all post-Illinoian vegetation would have been destroyed in that area, which then would have been occupied by invasion from the south. Here are two of the southern tree species—*Liquidambar styraciflua* and *Fraxinus profunda*. *Rosa setigera*, of midwestern range, is more abundant here and in the middle western part of the Illinoian till plain than elsewhere.

The floristic distinctness of the Illinoian till plain is due to the prevalence of the hydric or hydro-mesic environment favoring a group of species which find few possible habitats either to east or west; to the prevailingly acid soil, which may account for the absence or rarity of many of the species common in adjacent areas and for the presence of certain Alleghenian acid soil species; and to the glacial and post-glacial history of the area which favors the persistence of many northern species.

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NOTES ON THE FLORA OF GLACIER NATIONAL PARK, MONTANA

Willard T. McLaughlin

Since the publication of Standley's Flora of Glacier National Park[1] there have been seventy supplementary species and varieties added by various collectors,[2] bringing the total up to well over a thousand. The area is a fascinating one for botanical study, embracing, as it does, 1533 square miles of mountain territory of extreme ruggedness, and offering a variety of plant habitats ranging through four life zones, from plains to arctic-alpine summits and from sphagnum bogs to arid mountain sides. Many additional species would be included if the park boundaries were extended a few miles eastward into the plains. While the region has been visited by many botanists of note, the western side, north of Lake McDonald, botanically speaking is almost virgin territory.

The following notes are based on observations and collections extending over the five summers from 1930–1934.

* Phegopteris polypodioides Fée. Growing in crevices in dripping cliffs along the trail to Sperry Glacier above Sperry Chalets. August 1, 1931. No. 2080.

Standley states, in reference to *Phegopteris Dryopteris* (L.) Fée, "this species has been incorrectly reported from the park as *Phegopteris polypodioides* Fée." The writer is unable to determine who reported the latter species, but there is certainly no mistaking the identity of the two. Within the region *P. Dryopteris* is a common fern in moist coniferous woods at middle elevations where it is to be found growing with *Tiarella unifoliata* Hook. and *Clintonia uniflora* (Schult.) Kunth, while *P. polypodioides* seems to prefer the dolomitic cliffs at higher elevations in company with *Adiantum pedatum* L. var. *aleuticum* Rupr.

*Cystopteris montana (Lam.) Bernh. Moist ledges, Gunsight Pass. Collected by Mr. H. G. Rugg; July, 1932.

[1] Standley, Paul C. Flora of Glacier National Park, Montana. Contrib. U. S. Nat. Herb. **22**, part 5: 235–438. 1921.

[2] Graff, Paul W. Unreported Plants from Glacier National Park. Bull. Torrey Bot. Club **49**: 175–181. 1922. 32 species.

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* Not reported from the park by Standley or subsequent authors.

This interesting alpine and arctic fern is listed by Eaton as "certainly one of the very rarest of North American ferns." It has apparently been previously reported in the United States only from Colorado.

LARIX LYALLII Parl.

This endemic of the high mountain regions of the northwest is decidedly uncommon within the park. Concerning it Standley writes, "said to grow in a few places about timberline, but not seen by the writer." Maguire reports, "a fine grove at timberline, Preston Park." The present writer will never forget the arduous climb to the summit of the unfrequented Boulder Pass in the extreme northwestern corner of the park. After climbing above all but the most stalwart and matted arboreal alpines (*Abies lasiocarpa, Picea Engelmanni*, and *Pinus albicaulis*) the trail pauses for a brief spell on the margin of a great ice-scoured basin of dark red argillite, and there, sheltered from the chilling blasts, grows a beautiful grove of the mountain larch, sturdy and short and remarkably slow growing, distinguished at once from the lowland *Larix occidentalis* Nutt. by its stockier build and the very pubescent new growth.

SALIX COMMUTATA Bebb var. DENUDATA Bebb. Meadows, Iceberg Lake. July 21, 1930; No. 923. Reported previously only by Maguire from Gunsight Lake.

LEWISIA PYGMAEA (Gray) Robins. (*Oreobroma pygmaea* (A. Gray) Howell, of Standley). Collected by Umbach (Standley) at east entrance on creek bank. Collected by the writer in rocky alpine meadows near Sperry Glacier. July 10, 1931; no. 2125.

RANUNCULUS AQUATILIS L. var. CAPILLACEUS D. C. Probably the plant reported by Standley under *Batrachium Drouetii* (Schultz) Nyman.

PAPAVER PYGMAEUM Rydb.

This diminutive little poppy of the high ridges and moraines is seldom to be found in any abundance. The writer found a single plant on the moraine of Blackfoot Glacier and perhaps fifteen or twenty individuals within a few square yards on the moraine of Sexton Glacier. Rydberg's original description[1] states that the petals are yellow, but all the specimens seen agree rather with Standley's description, "petals orange with a yellow spot at the base."

*SMELOWSKIA LOBATA Rydb. Rocky alpine meadow east of summit of Logan Pass. July 20, 1932; no. 2540. Rocky alpine meadow near summit, Siyeh Pass. July 15, 1934; no. 3296.

[1] Rydberg, P. A. Studies in the Rocky Mountain Flora VII. Bull. Torrey Bot. Club 29: 145–160. 1902.

In the latter location the plant was growing with or at a slightly higher elevation than *S. americana* Rydb., and is later flowering than this species.

Physaria didymocarpa (Hook.) A. Gray. Collected on a dry talus slope at 6500 feet elevation in Baring Basin where it grew with *Eriogonum depressum* (Blankinship) Rydb.

The *Physaria* is characteristically a plains species, but, like many another, is quite at home on dry open mountainsides at high elevations.

Parnassia palustris L. Previously reported from a wet thicket at St. Marys. Collected at Mud Lake and in boggy ground at the lower end of Lower Kintla Lake.

Probably fairly common in low ground on the west slope.

*Tellima grandiflora (Pursh) Dougl. Under bushes along Granite Park fire trail an eighth of a mile from the Going-to-the-Sun Highway. June 25, 1934; no. 3224.

A diligent search failed to reveal more than a single plant. This is apparently the easternmost station for this Pacific slope species.

*Philadelphus Lewisii Pursh. Growing in abundance on a dry, rocky hillside along the highway, one mile east of Going-to-the-Sun Chalets. July 16, 1934; no. 3275.

Hypericum Scouleri Hook. Under bushes near Going-to-the-Sun Chalets. July 24, 1933; no 2955.

The plants were taller and more lax than the usual form characteristic of the alpine meadows and open slopes.

Epilobium angustifolium L. var. platyphyllum (Daniels) Fernald.[1]

The fireweed within the park certainly attains the perfection of its development at lower levels along the plains margin and in burned over areas, but it is also found in great abundance in meadows within the Hudsonian zone. By August first it is, in many of these higher meadows, the dominant plant. Prof. Fernald, in his discussion of possible hybridization between *Epilobium latifolium* L. and *E. angustifolium*[2] states, "that imperfection of pollen in this species cannot be asserted to be due to hybridization with *E. latifolium* should be apparent from the vast distances (often 100 to 1000 miles and sometimes overseas) between the supposed hybrid offspring and the nearest colonies of one of the assumed parents." However, in Glacier Park the two species in the vicinity of Logan Pass and elsewhere do grow within a few feet of one another. Moreover, as Standley has

[1] Fernald, M. L. American Variations of Epilobium, Section Chamaenerion. Rhodora 20: 1–10. 1918.

[2] Fernald, l. c. 10.

pointed out, *E. latifolium* is found occasionally at low altitudes growing along stream margins.[1]

*Cornus stolonifera Michx. var. Baileyi (Coult. & Evans) A. A. Drescher[2] (*C. Baileyi* Coult. & Evans of authors).

Although Standley reports only *C. stolonifera* it has already been pointed out[3] that the common form west of the divide is not *C. stolonifera* but is apparently referable to *C. stolonifera* var. *Baileyi*. On the other hand all the east side collections made by the writer are typical *C. stolonifera*.

*Phyllodoce hybrida Rydb. Probably a hybrid between *P. empetriformis* (Smith) Don and *P. glandulifera* (Hook.) Coville. Especially abundant at the summit of Logan Pass, growing with the two parent species.

Ledum glandulosum Nutt. In spongy ground near the summit of Boulder Pass. Sept. 8, 1931; no. 3321.

Reported by Standley as a lowland species; here growing at about 7500 feet.

*Dodecatheon acuminatum Rydb. Wet mossy bank, Virginia Falls, Upper St. Mary's Valley. August 13, 1934; no. 3317.

Pinguicula vulgaris L. Wet spongy bank near Hidden Lake at 7000 feet elevation. July 30, 1932; no. 2589.

*Orobanche Sedi (Suksd.) Fernald.[4] Grinnell Glacier Trail, 5500 feet elevation. July 13, 1930; no. 787. In moist rock crevices, parasitic on *Thalictrum megacarpum* Torr. Mt. Brown; July 4, 1931.

Erigeron lanatus Hook. Fairly abundant near the summit of Siyeh Pass.

In all plants seen by the writer the rays were white.

Northwestern University,
Evanston, Illinois.

Eleocharis caribaea, var. dispar in Ontario.—While working over a collection of plants presented to the Herbarium of the University of Toronto by Dr. R. F. Cain, the writer was pleased to find a

[1] In the discussion cited, Fernald merely pointed out that certain individuals which had been designated, in the paper criticized, as hybrids of *Epilobium angustifolium* and *E. latifolium*, merely because of their imperfect pollen, were growing 100 to 1000 miles away from the nearest colonies of the latter species. In much of the limited range of *E. latifolium*, *E. angustifolium* is present; from much of the extensive area of *E. angustifolium*, *E. latifolium* is absent.—Eds.

[2] Drescher, A. A. Preliminary Reports on the Flora of Wisconsin XXII. Cornaceae. Trans. Wisconsin Acad. Sciences, Arts, and Letters **28**: 187–190. 1933.

[3] Blankinship, J. W. Supplement to the Flora of Montana. Montana Agric. Coll. Sci. Studies **1**: 32–109. 1905.

[4] Not *O. uniflora* L. See Fernald, M. L. Two Summers of Botanizing in Newfoundland. Rhodora **28**: 236. 1926.

specimen that agreed very closely with the published descriptions of *Eleocharis caribaea* (Rottb.) Blake, var. *dispar* (E. J. Hill) Blake. This identification has since been confirmed by Dr. M. L. Fernald. The specimen may be cited:

In wet sand on Lake Erie shore, Rondeau Provincial Park, Kent Co., Ontario, *R. F. Cain*, Aug. 14, 1934.

This is apparently the first record of this very local variety, other than from Whiting, Indiana, where it has been known for many years. The Ontario record marks such a surprising jump eastward in its range that one is led to expect that careful collecting in the region of the lower Great Lakes will reveal its presence elsewhere between these two stations.

A duplicate specimen has been deposited at the Gray Herbarium.—T. M. C. Taylor, Department of Botany, University of Toronto.

Eleocharis caribaea, var. dispar in Michigan.—The inland variety, *Eleocharis caribaea* (Rottb.) Blake, var. *dispar* (E. J. Hill) Blake, of the tropical and subtropical chiefly coastal plain species, *E. caribaea*, has heretofore been known only from the type locality at Whiting, Lake County, Indiana, where apparently it has not been collected during the past forty years.[1] Consequently it was with no little surprise that the writer came upon an extensive colony of it at Silver Lake, Washtenaw County, Michigan during the past summer, —a station approximately 200 miles northeast of the type locality. Here, on the wet, sandy margin of a large pond, it was growing profusely associated with *E. acicularis* and *E. olivacea*, *Cyperus rivularis*, *Rynchospora capillacea*, *Juncus alpinus* var. *fuscescens*, *J. brachycephalus*, *Lobelia Kalmii*, *Agalinis paupercula* var. *borealis*, *Mariscus mariscoides*, *Lycopus americanus*, *Hypericum virginicum*, *Panicum flexile* amd *Spiranthes cernua*.

Recently it was learned that Mr. Deam had also discovered *E. caribaea* var. *dispar* at three additional stations for Indiana, all during the summer of 1934, so that its distribution is not as restricted as had been supposed and further collections of the Eleochares may be expected to reveal it from other localities adjacent to the southern shores of the lower Great Lakes.

The data for the recent collections of this plant are as follows:

Indiana: east side of Little Chapman Lake, 4 miles northeast of

[1] Svenson, H. K. Monographic Studies in the Genus Eleocharis. Rhodora 31: 227. 1929.

Warsaw, Kosciusko County, *C. C. Deam*, no. 55,328; north end of Clark St., Gary (formerly Pine), Lake County, *C. C. Deam*, no. 55,529; low marl border of east side of Adams Lake, 3 miles northeast of Wolcotville, Lagrange County, August 16, 1934, *C. C. Deam*, no. 55,357A. MICHIGAN: open, sandy shore of pond east of Silver Lake, 6½ miles northwest of Dexter, Washtenaw County, August 31, 1934, *F. J. Hermann*, no. 6430 (Gray Herbarium, Brooklyn Botanic Garden), and November 26, 1934, no. 6457.—F. J. HERMANN, University of Michigan.

ACORUS CALAMUS IN AMERICA

MURRAY F. BUELL

ACORUS CALAMUS L. in its several varieties grows without cultivation over a large part of the north temperate zone and the adjacent tropics. In eastern Asia, where Engler[1] recognizes four varieties, it occurs in one form or another from Ceylon to the Amur River, and inland as far as Lake Baikal. In Europe it occurs from the Alps northward to Scandinavia and Russia, and in a few places in the Mediterranean region. In North America it is widely distributed east of the Rocky Mountains from the Gulf of St. Lawrence to Florida, and westward to Texas, Montana, and as far north as the Peace River. In both Europe and North America the plant seems to belong uniformly to Linnaeus' var. *vulgaris*.

No one seems ever to have questioned that the species in some form is indigenous in Asia. The presence of several varieties not known elsewhere, and the occurrence of a second species (*A. gramineus*) with a substantially similar range, seem to indicate its native status beyond a shadow of doubt.

In Europe, although the plant is said to be uniformly sterile, botanists did not seriously question its indigenous status until the second half of the nineteenth century, but by the beginning of the present century European botanists seem to have been pretty well agreed that it is an introduced plant which has become naturalized since the middle of the sixteenth century, and the researches of Mücke fully confirm this.[2]

As to its status in North America various opinions are expressed by

[1] ENGLER, Das Pflanzenreich, IV, 23 B. 308. (1905).

[2] See ENGLER, l. c.; ASCHERSON AND GRAEBNER, Synopsis, II, 2. 365 (1904). Mücke, M., Über den Bau und die Entwicklung der Früchte und über die Herkünft von Acorus calamus L. Bot. Zeit. LXVI, 1–23. (1908). According to the latter author the immediate source of the plant was from living rhizomes sent from Constantinople to Matthiolus in Prague in 1557, and to Clusius in Vienna in 1574. What was the ultimate source of this material remains to be determined.

different authors: Asa Gray[1] says of it: "Probably truly indigenous northward." Dame and Collins[2] believe it to be native in Massachusetts. On the other hand, Chapman[3] states that in the southern United States it is "apparently introduced." As to its condition in the interior of the continent, Melvin Gilmore[4] believes that it was brought by the Indians from the Atlantic coast and that elsewhere it occurs only near the sites of old Indian camping grounds. In his discussion he makes the statement, "Calamus is a plant which very seldom blooms and I have never known it to produce seeds, so that it is not adapted to disseminate itself or invade new territory."

This is certainly not a correct statement of the situation in Minnesota, nor apparently in other parts of the interior of North America. I have found it producing good fruit at widely scattered locations in Minnesota: in the east central part of the state at Savage in Scott County and also along the Mississippi River at St. Paul; two hundred miles to the northwest at the headwaters of the Mississippi; even farther to the northeast near Ely, St. Louis County, where the plant was thriving in a backwater of Stony River, and again on the sandy shore of Burntside Lake. Furthermore, University of Minnesota herbarium specimens show well developed fruiting spikes from all parts of Minnesota, and the same is true of specimens from Illlinois and Indiana, and as far east as northern New York. Through correspondence with botanists in various parts of the country I have learned that this range of good fruiting material may be extended as far south as Kansas and Missouri.

The places where the plant fails to produce fruit here are those locations where it is shaded for a good part of the day or where the ground dries out during early or mid-summer. Calamus seems to thrive only where the rhizome is continuously submerged, at least until late summer, and where it receives the maximum sunlight. Soil type has considerable effect on its luxuriance. Where plants are growing in sand, vegetative growth is less; where they are rooted in rich humus or muck, the rhizomes and leaves are conspicuously larger, but in either case it fruits freely. The seeds produced are viable and germinate readily the following spring. How frequently they germinate in nature in Minnesota is not known, but in at least

[1] Gray, Manual. ed. 5. 478. (1868).

[2] Dame, L. L. and F. S. Collins, Flora of Middlesex. 98. (1888).

[3] Chapman, Flora. ed. 3. 466. (1897).

[4] Gilmore, Melvin R. Dispersal by Indians a factor in the extension of discontinuous distribution of certain species of native plants. Papers Mich. Acad. Sci. Arts and Letters. XIII, 89–94. (1931).

one case I have found abundant vigorous seedlings. This was in late June, 1933, on the shores of Burntside Lake near Ely, in one of the coldest parts of the state.

There seems no valid reason to doubt that *Acorus Calamus* is native to North America. There are in the Gray Herbarium a few fruiting specimens from New England,[1] and the facts seem to indicate very definitely that the plant is wholly native in the interior. Here in Minnesota the plant is common throughout the state and bears fruit freely. There is nothing about the local distribution to suggest an introduced plant. Its general distribution is very much like that of *Symplocarpus foetidus* and the genus *Arisaema* of the *Araceae*, as well as many other genera and even species of other families, i. e., it occurs in Asia and eastern North America.[2] This distribution is known in many cases to be a direct result of the Pleistocene disruption of an earlier and much wider circumboreal range. One does not question that *Symplocarpus* has lived in our swamps or *Arisaema* in our woods for ages past. It seems no more than reasonable to assume that these hardy aroids of similar distribution have had the same paleontological history, though the records in the case of *Acorus* have become much blurred by human interference.

University of Minnesota.

Hitchcock's Manual of the Grasses.—For several years botanists of the United States have been looking forward to the appearance of Hitchcock's illustrated volume on the grasses. Now, in May, the first copies have become generally available, although the title-page says

[1] It has been suggested that the sterile European race may have been introduced into certain parts of North America. Without doubt the early settlers along the Atlantic coast were familiar with the domestic uses of the plant. In fact even to-day the rhizomes are used somewhat by their descendants in making candy, and in rural New England one occasionally finds "candied sweet flag" for sale. These settlers possibly brought rhizomes of *Acorus* with them, and it seems possible that some of the material now growing wild in the older settled areas is actually from this source. In this connection see Graves, C. B., et al, Catalogue of the flowering plants and ferns of Connecticut. 111. (1910).

[2] Its actual status seems to be intermediate between the two genera cited. *Symplocarpus*, a monotypic genus, occurs in apparently identical form in eastern North America and temperate East Asia. *Arisaema* with two or three species in eastern North America extending into South America has several closely related though obviously distinct species in temperate eastern Asia, as well as a large number of species in the tropics of the Old World. *Acorus Calamus* occurs as var. *vulgaris* in the eastern half of North America, and at least in large part as distinct varieties in eastern and southeastern Asia, while there is a second Asiatic species. Engler, indeed, cites several east Asiatic localities for var. *vulgaris*. Not having seen any Asiatic specimens, I am unable to judge whether these are identical with our North American material. If they are, the natural distribution of this variety would be very like that of the skunk cabbage cited above.

"Issued February 1935." The book[1] is a plump work of more than a thousand pages and abundant illustrations. In typography and paper it is a typical product of the Government Printing Office. Each genus is illustrated, often by the excellent drawings already generally familiar in earlier works, such as *The Genera of Grasses of the United States* (1920), and many species are partially illustrated by inset figures, with maps intended to show their ranges; the genera are supplied with block-keys and a stereotyped description is given for each species. In sequence of tribes the admirable system of the late Professor C. E. Bessey (1911) is essentially followed, although the source of the system is obscured by the statement: "The sequence of tribes and genera . . . is that found in The Genera of Grasses of the United States" (Hitchcock, 1920), where Bessey was not mentioned and his phylogenetic sequence was announced as "a new sequence based on the complexity of the flower structure." The sequence is the most natural yet proposed and it is, therefore, desirable that its author be remembered.

In detail the work is, naturally, the record of its author's judgments regarding generic and specific lines; and, in estimating it from the viewpoint of a taxonomist who has studied the grasses, along with many other groups, in the northeastern States, it must be clearly emphasized that he cannot speak for critical students in other sections of the country. With the generic treatments, which in only a few places (as in the *Paniceae*) seriously depart from the well known concepts of Hackel, most botanists will agree. With the specific treatments there will be less agreement; the standards for species in the book are altogether too elastic. The very trivial and inconstant fluctuations of pubescence and the minutest differences in size of spikelets in *Panicum* are still maintained as characterizing sound species (*P. Werneri* and *linearifolium; P. xalapense* and *laxiflorum; P. Clutei* and *mattamuskeetense; P. barbulatum* and *dichotomum; P. implicatum, huachucae,* etc.; *P. tsugetorum* and *columbianum; P. Helleri, Scribnerianum* and *oligosanthes;* etc.). Similarly quite trivial differences in length and abundance of pubescence (largely a vegetative response) and in small fractions of millimeters in size of spikelets are treated as specific in other groups (*Paspalum,* etc.). These matters have been sufficiently studied[2] by competent field-botanists who intimately know their own grasses so that the maintenance of thoroughly discredited "species" as on a par with unquestioned and invariable ones cannot appeal to any but those who set the lowest standard for species.

Singularly enough, Hitchcock often "leans over backward" in his unwillingness to recognize as species or even as varieties or distinguishable forms plants which other discriminating field-botanists of long experience never hesitate to call true species. *Agrostis hyemalis* (Walt.) BSP. (*A. antecedens* Bicknell) is a good illustration. This and *A. scabra* Willd. are treated by Hitchcock as identical, under *A. hyemalis* (the specific name unjustifiably altered by him from Walter's original to *hiemalis*).

[1] A. S. Hitchcock, *Manual of the Grasses of the United States* (U. S. Dept. Agric. Misc. Pub. no. 220). 1040 pp., 1696 figs. Washington, ? February, 1935. For sale by Superintendent of Documents, Washington, D. C. Price $1.75.

[2] See, for instance, Deam, Grasses of Indiana (1929); Fernald, Rhodora, xxiii. 223–228 (1921, 1922), xxxvi. 20–22 and 61–87 (1934); Fogg, Rhodora, xxxii. 233 (1930); House, Bull, N. Y. State Mus. no. 254 (1924); Stone, Pl. So. N. J. (1910); Weatherby, Rhodora, xxx. 134 (1928); Weatherby & Griscom, Rhodora, xxxvi. 35 (1934); Weatherby, Knowlton & Bean, Rhodora, xxxi. 107 (1927); Wiegand & Eames, Fl. Cayuga L. Basin (1926).

Nevertheless, the common and characteristic plant of Walter's territory, flowering in the south at the break of winter or the opening of spring (whence Walter's name *Cornucopiae hyemalis* and Bicknell's *Agrostis antecedens*), is thoroughly distinct from the plant of general Canadian, Alleghenian and transcontinental range, but extending only rarely into the coastal plain southward, which Willdenow described as *A. scabra*.

Personally, I do not know any acute field-botanist, familiar with the two plants, who does not at once distinguish them. Bicknell, as acute an observer as any who has worked on the flora of New York and New England, clearly understood them, though he failed to emphasize some characters which have later come to light; and another of our most accurate field-botanists (but far more conservative than Bicknell), discussing *A. antecedens*, "proposed by a most discriminating botanist," pointed out the different branching, "smaller spikelets more clustered at the ends of the short branchlets" and the "flowering period distinctive" (Bayard Long in Bartonia, no. 8: 17 (1924)). The differences between the two species are shown photographically in RHODORA, XXXV. t. 246 (1933).

Similarly, other sound species, obviously not clearly understood by the author, are suppressed, with the result, already noted, that the treatments of different genera are very unequal.

In looking over the keys one is at once impressed with the frequent dependence upon variable characters of pubescence and similar points, rather than upon more stable morphological characters. In the key to *Bromus*, for instance, *B. ciliatus* comes under a division (p. 34),

> Lemmas pubescent along the margin and on lower part of the back, the upper part glabrous;

while *B. purgans* and *B. latiglumis* are contrasted with it under

> Lemmas pubescent rather evenly over the back, usually more densely so along the lower part of the margin.

For the unfortunate collector who happens to get hold of *B. purgans*, forma *glabriflorus* Wieg., with lemmas glabrous, "it is just too bad." There are beautifully definite morphological characters separating these three species of *Bromus* but they are not noted in the key and the descriptions. Incidentally, the embarrassing *B. purgans*, forma *glabriflorus* is not mentioned in the body of the work; the name may possibly be enumerated in the voluminous lists of synonyms at the end of the book. The objection to recognizing forms as such is rather general throughout the book. For instance, still using *Bromus* as illustrative, under *B. latiglumis* (p. 45) we find that "A form with densely canescent sheaths has been called *B. incanus* (Shear) Hitchc." A proper formal combination was available; see RHODORA, XXXV. 316 (1933).

The drawings illustrating genera have been noted as copied largely from earlier publications and being most satisfactorily illustrative. It would have been a great help to the user if equal care and direction had been given to the small inserts representing different species. With *Bromus* still before us, look at figs. 18–21 on pages 42 and 43; scarcely a diagnostic point is shown and the confident user is bound to wonder what are the differences. Very similarly with many other groups, the mere illustration of bits of similar inflorescences, without any attempt to display the distinctive characters, gives a specious assurance which will often mislead. How, for instance, will the inexperienced beginner know

whether his specimen should go with fig. 993, 994 or 997 (*Aristida*) or whether his *Paspalum* matches fig. 1227, 1229 or 1231?

The maps displaying ranges have been referred to. These are very small and rigidly confine themselves to the United States, so that in many cases they are not complete maps of the North American range. They give a very general idea of whether the plant is eastern, western, northern or southern but the satisfaction in most cases with a single dot somewhere near the geographic center of each state represented too often leads to a visualization which is far from accurate. *Triplasis purpurea* is characteristic along the Atlantic and the lower Great Lakes; but from Hitchcock's map it would be too easy to infer that it grows in the White Mountains of New Hampshire, in central New York (House says: "especially along the sea beaches of Long Island and Staten Island. Reported from the Great Lakes, Buffalo"), in the Alleghenies of Pennsylvania (Porter cites it for all Pennsylvania only from Presque Isle, on Lake Erie) and from the upland of central Ohio (Schaffner cites it only from shores of Lake Erie). In some cases, notably in *Panicum* and *Spartina*, the coastal distribution of many species is more satisfactorily indicated.

In nomenclature the International Rules are largely followed, but one departure from the SPIRIT (though not the letter) of the International Rules is conspicuous. All personal genitives used as specific names are decapitalized, the International Rules strongly urging, as a recommendation, the slight concession to good taste and scholarship embodied in the capital initial; but here we get *Bromus pumpellianus, suksdorfii, orcuttianus* and all the rest with undignified initials, so that one cannot help wondering if the author thinks that such decapitalization is recommended in the International Rules. Before and at the Cambridge Congress he emphasized that, if certain points were altered, he would accept and follow the Cambridge decisions. The points he urged were accepted. The wholly unjustifiable *Agropyron pauciflorum* (Schweinitz) Hitchc. (1933 or 1934) is maintained, in spite of the earlier *A. pauciflorum* Schur (1859). The violation of the "homonym rule," a rule for which Hitchcock stood at Cambridge, by the publication of *A. pauciflorum* (Schweinitz) Hitchc. was sufficiently elucidated in RHODORA, xxxvi. 417–419 (1934). But in the main the International Rules are followed. For an extended work emanating from Washington this is a welcome innovation.

Enough has been noted to make it clear that Hitchcock's Manual is bound to be a stimulating and provocative volume. The close students of grasses are too few and the inclination in many quarters is to leave them to the specialist. The drawing together into one volume of treatments of all the genera of grasses in the vast and highly diversified area of the United States is a tremendous advance. The very different interpretations of many of them by the author and by others who intimately know them in special and limited areas will lead to a healthy re-study and re-evaluation of many which are now debatable. The bibliographic material is now before us for further and critical consideration. For thus assembling it our most cordial thanks are extended to Professor Hitchcock.—M. L. F.

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